INSTRUCTION MANUAL

EB 2300S

(supplement to EB 2300)

for

F. M. / A. M. MODULATION METER

TF 2300S

CHANGE OF FREQUENCY UNIT

Marconi Instruments, in accordance with international usage, has decided to adopt the hertz (Hz) as the name of the unit of frequency in place of the cycle per second (c/s). During the transition period the frequency units in this instruction manual may not agree with those on the equipment. The value of the alternative units and that of their multiples – kHz and kc/s, MHz and Mc/s, GHz and Gc/s – is, however, identical.

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ST. ALBANS HERTFORDSHIRE ENGLAND

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General information

1.1 INTRODUCTION

This manual is a supplement to Instruction Manual No. EB 2300 and describes the points of difference between TF 2300S and TF 2300. For information not covered in the supplement please consult EB 2300.

The FM/AM Modulation Meter type TF 2300S has a different oscillator unit from the TF 2300 (TM 8045/1 in place of TM 8045); this has an additional range (RANGE A) which enables inputs from 2 Mc/s to 4 Mc/s to be measured. A supplementary deviation range of 1.5 kc/s is also provided. A short lead is supplied to connect the OSCILLATOR to the main instrument on range A.

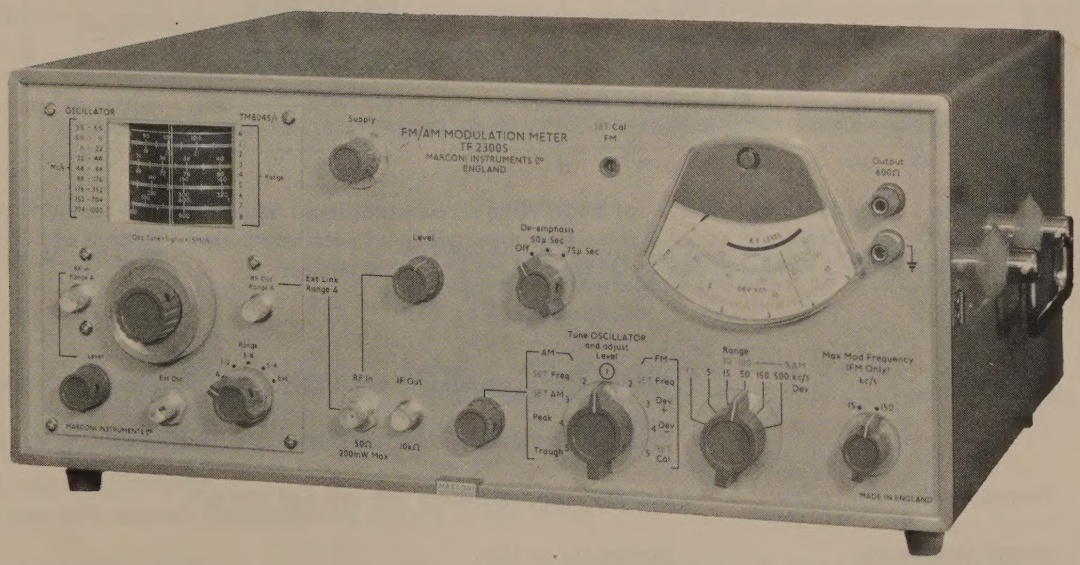


Fig. 1.1 F. M./A. M. Modulation Meter, type TF 2300S.

1.2 DATA SUMMARY OF TF 2300S

R. F. INPUT

Frequency range:	2 Mc/s to 1000 Mc/s.
Sensitivity:	Less than 20 mV between 2 Mc/s and 250 Mc/s. Less than 50 mV between 250 Mc/s and 500 Mc/s. Less than 100 mV between 500 Mc/s and 1000 Mc/s.
Maximum input:	3 V r.m.s.
Input impedance:	Nominally 50 Ω.

LOCAL OSCILLATOR

Frequency range: Calibrated in terms of internal oscillator frequency.

Range	Local Osc. freq. (Mc/s) (Dial Calibration)	Signal freq. range (Mc/s)
A	3.5 - 5.5	2 - 4
1	5.5 - 11.0	4 - 9.5
2	11.0 - 22.0	9.5 - 20.5
3	22.0 - 44.0	20.5 - 42.5
4	44.0 - 88.0	42.5 - 86.5
5	88.0 - 176.0	86.5 - 174.5
6	176.0 - 352.0	174.5 - 350.5
7	352.0 - 704.0	350.5 - 702.5
8	704.0 -1001.5	702.5 -1000

Scale accuracy: ±3%.

For ranges 1 to 8 provision is made for connecting an external local oscillator with an output of approximately 200mV. (Note: by using a noise free external local oscillator, noise figures of -70 dB with respect to the 50 kc/s deviation can be obtained from 4 to 1000 Mc/s.)

I. F. OUTPUT

Frequency:	Ranges 1 to 8, bandwidth nominally 1 Mc/s centred on 1.5 Mc/s. Range A, bandwidth nominally 100 kc/s centred on 1.5 Mc/s.
Output level:	Between approximately 200 mV and 500 mV.
Output impedance:	Nominally 10 kΩ.

F. M. MEASUREMENT

Deviation:	6 ranges: 1.5, 5, 15, 50, 150 and 500 kc/s f.s.d. Positive or negative deviation selected by a switch.
Modulation frequency:	On all ranges, except the 1.5 kc/s f.s.d deviation range and R. F. Range A, 30 c/s to 150 kc/s, and deviations up to 500 kc/s.

On the 1.5 kc/s range the mod. freq. range is 30 c/s to 3.4 kc/s and on Range A the deviation is limited to a maximum of 5 kc/s.

Accuracy:

±3% f.s.d. for deviations up to 150 kc/s and mod. frequencies between 30 c/s and 15 kc/s.
±5% on 1.5 kc/s f.s.d. deviation range.

±5% of f.s.d. for deviations up to 500 kc/s and mod. frequencies between 30 c/s and 150 kc/s.

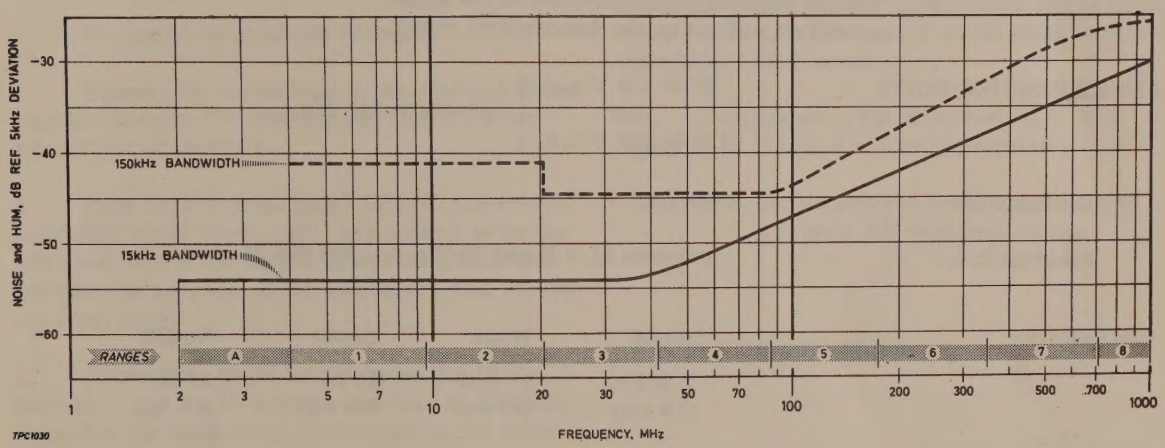
Distortion:

Less than 0.25% for deviations up to ±75 kc/s and mod. frequencies up to 15 kc/s.

Less than 0.5% for deviations up to ±300 kc/s, and mod. frequencies up to 25 kc/s.

Less than 3% for deviations up to ±500 kc/s and mod. frequencies up to 150 kc/s.

Noise output:



F.M. on A.M.:

Ranges 1 to 8; additional deviation error, when the a.m. depth is 80% and the modulating frequency is 1 kc/s, is less than 1 kc/s in a 15 kc/s bandwidth.

Range A; additional deviation error, when the a.m. depth is 10% and the modulating frequency is 1 kc/s , is less than 75 c/s in a 15 kc/s bandwidth.

A.M. MEASUREMENT
(For use with carrier frequencies of 2 Mc/s to 350 Mc/s)

Modulation depth:

Two ranges: 30% and 100% f.s.d. (maximum usable reading 95%).

Peak and Trough readings selected by a switch.

Accuracy:

±5% of f.s.d. for mod. frequencies of 30 c/s to 15 kc/s (Ranges 1 to 8) and 30 c/s to 3.4 kc/s (Range A).

Distortion:

Less than 1% up to 60% mod.depth, less than 3% up to 90% mod.depth.

L. F. OUTPUT

Frequency range:	Ranges 1 to 8, 30 c/s to 150 kc/s with switchable low pass filter at 15 kc/s on f. m. except for the 1. 5 kc/s deviation range.
	30 c/s to 50 kc/s on a. m.
	Range A: Max. mod. frequency restricted to 3. 4 kc/s on f. m. and a. m.
De-emphasis:	Selected by a switch at 0, 50 and 75 μsec.
Output level:	Nominally 0 dBm (into 600 Ω load) except on 1. 5 kc/s deviation range.

NOTE: On the 1. 5 kc/s deviation range:

i) Mod. frequency range is 30 c/s to 3. 4 kc/s.
ii) Output nominally -10 dBm (into 600 Ω load).
iii) The de-emphasis also operates on the meter circuit as well as on the demodulated output.

POWER REQUIREMENTS

95 to 130 V a. c.)
or) 45 c/s to 500 c/s.
190 to 260 V a. c.)

Consumption: 15 VA.

External d. c. : Between 21. 5 V and 30 V d. c. , 320 mA at 24 V d. c.

DIMENSIONS

Height	Width	Depth	Weight
7 3/4 in (19 cm)	18 $\frac{1}{2}$ in (47 cm)	15 in (38 cm)	31 lb (15 kg)

1.3 ACCESSORIES

Supplied

Mains Lead, 43122-017.
Lead for Range A operation TM 4726/328. 43125-060.
Protective Cover for the front panel TM 7958/3A, 41625-052.

Optional

Shielded Adaptor for converting the OUTPUT terminals to BNC coaxial socket, 43168-008.

Section 2

Operation

2.1 OPERATION ON RANGE A

As on TF 2300 the TF 2300S on all ranges is calibrated in terms of the apparent oscillator frequency. This is the same as the input frequency plus 1.5 Mc/s. Range A is therefore calibrated from 3.5 to 5.5 Mc/s, and covers a range of 2 to 4 Mc/s.

To operate proceed as follows:

1. Connect the instrument to the relevant power supply: (See the TF 2300 manual Sect. 2.2 for adjustment of supply.)

2. Turn the two front panel LEVEL controls to maximum (fully clockwise); one control is on the left hand side at the bottom of the oscillator unit, the other is adjacent to the oscillator, half way up the front panel.

3. Connect the short lead between RF OUT RANGE A and RF IN sockets (the lead is normally stowed at the back of the instrument on the clips provided.

4. Check mechanical zero of the meter and adjust as necessary.

5. Connect the signal to the RF IN RANGE A socket; the signal should not be greater than 3 V r.m.s. (See EB 2300 Sect. 2.4.)

6. Switch the RANGE switch to A.

7. Turn the supply switch so that the red segments show.

8. Switch the meter function switch to TUNE OSCILLATOR AND ADJUST LEVEL and adjust the oscillator tuning control until a reading is obtained on the meter in the RF Level sector (black arc).

9. Adjust the level by means of the oscillator LEVEL control so that the tuning control may be adjusted for peak while still reading on the black arc. (The LEVEL control on the main instrument should be left at maximum.)

10. Continue as in EB 2300 Sect. 2.5, 2.6, ignoring 2.5.5 or 2.6.3 as appropriate.

CAUTION: Do not attempt to SET CAL on the 1.5 kc/s FM deviation range.

2.2 OTHER CHANGES

Other changes to EB 2300 manual when used with a type TF 2300S are:

Sect. 2.3 CONTROL 17, DE-EMPHASIS - on the 1.5 kc/s DEV RANGE the DE-EMPHASIS does affect the meter reading.

Sect. 2.13. On 1.5 kc/s DEVIATION RANGE the output level will be 0.1 mW.

Sect. 2.15. Crystal selection; as the crystal control facility is deleted in the type TF 2300S this section is redundant.

Section 3

Technical description

This section contains information on the parts which differ from those described in Sect. 3 of the EB 2300 Instruction Manual.

3.1 GENERAL

3.1.1 Range A

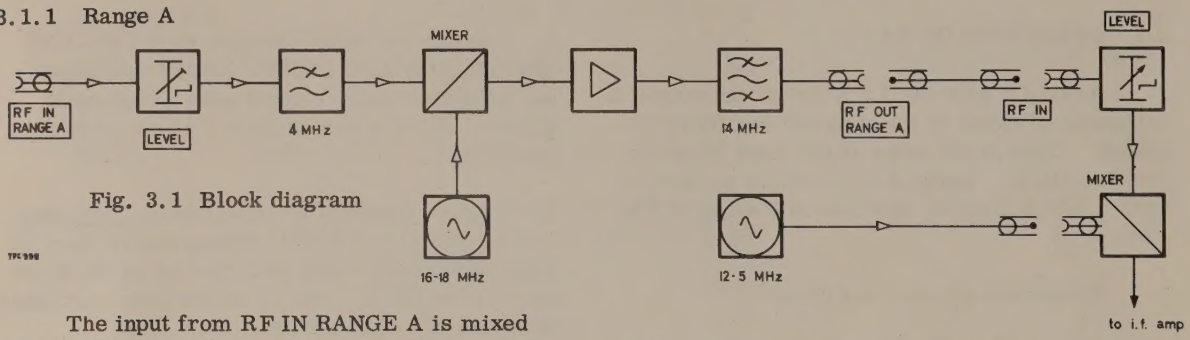


Fig. 3.1 Block diagram

The input from RF IN RANGE A is mixed with a 16 to 18 Mc/s signal (generated inside the oscillator (and the difference frequency of 14 Mc/s is fed to the RF OUT RANGE A socket.

After passing through the short connecting link, TM 4726/328, the signal enters the main instrument through the RF IN socket. The signal is then mixed with a 12.5 Mc/s sine wave from the local oscillator. The resulting 1.5 Mc/s i.f. then passes through the instrument as detailed in Sect.3.1.

3.1.2 1.5 kc/s frequency deviation range

On this deviation range the output from the 2nd l.f. amplifier is monitored, instead of between the two stages making up the amplifier, as for the other ranges.

A component board type TM 8742, unit 14, mounts the components for this range.

3.2 FREQUENCY CHANGER - Unit A2c/S

This information is additional to that contained in Sect. 3.4 of EB 2300.

On Range A (2-4 Mc/s input frequency) the input signal is applied to the RF IN RANGE A socket, on the oscillator unit, TM 8045/1, and then via the LEVEL control, A0/SRV1, to a 4 Mc/s Filter. The filter's function is to stop harmonics of the RF IN RANGE A socket reaching the mixer. The signal is next combined with a signal from a variable frequency local oscillator, to give a signal of 14 Mc/s. This oscillator is of modified Colpitts form, similar to those described in Sect. 3.4 of EB 2300. It has a frequency range between 16 and 18 Mc/s, which is adjusted by the OSCILLATOR TUNE control.

The resulting 14.0 Mc/s signal is then mixed with a 12.5 Mc/s signal derived in unit A2d/S giving 1.5 Mc/s i.f. signal; after this it is handled as described in Sect. 3 of EB 2300.

3.3 FIXED FREQUENCY LOCAL OSCILLATOR Unit A2d

This 12.5 Mc/s oscillator is a modified Colpitts type, and is similar to that described in Sect. 3.4 of EB 2300. It is positioned inside TM 8045/1.

3.4 OTHER UNITS

The 2nd l.f. amplifier, unit A9, and the peak reading voltmeter, unit A10, have one extra contact each, pins 11 and 12 respectively. This has resulted in a change of board number - the 2nd l.f. amplifier becoming TM 8806 and the peak reading voltmeter TM 8805. However, the remainder of the circuitry is the same as that of the corresponding units in TF 2300 and so the description in EB 2300 of these units is correct.

Section 4

Maintenance

4.1 GENERAL

This information supplements that contained in the EB 2300 manual. Limits quoted in this section that are not in the Data Summary are for information only and are not guaranteed.

Apparatus required:

a) BNC T connector.
b) Counter; mi type TF 1417 series.
c) Converter; mi type TF 2400/1.
d) R. F. Millivoltmeter; mi type TF 2603.
e) Signal Generator; mi type TF 144H series.

4.2 LOCAL OSCILLATOR FREQUENCY

Apparatus required: a, b, c, d, e.

1) Connect the BNC T connector, TM 8752, in the link between the mixer, TM 7723, and oscillator, and the counter and converter to the free end of the connector.

2) Adjust coil L6 on TM 8752 to set the frequency of the fixed oscillator to 12. 5 MHz.

3) Replace the counter and converter with the r.f. millivoltmeter and adjust RV2 on TM 9029 to give an output of 200 mV.

4) Connect the counter and converter to the RF OUT RANGE A socket.

5) Tune the Variable Oscillator from end to end of the range and adjust L9 on TM 9030 to set the range extremities to 15 and 19 MHz at the end stops.

6) Tune the variable oscillator to 17 MHz and connect the standard signal generator, TF 144H, to 3 MHz.

7) Adjust coils L5 and L6 to the maximum 14 MHz i.f. output as shown on the Tune/Level meter on the converter.

8) Adjust coil L11 for the maximum output without spurious oscillation at the low end of RANGE A.

Section 5

Replaceable parts

Introduction

The Replaceable Parts List for TF 2300S is the same as that in EB 2300 with the following changes:

Circuit Ref.	Description	M.I. code
A0/S - Main Assembly		
C9	Paper 0.05μF 10% 350V	26147-167
C10	Paper 500 pF ±20%	26174-122
R5	deleted	
R13	Met film 1.18kΩ 0.5% 0.25W*	24635-004
RV4	WW 250Ω 10% 1W°	25815-102
RV5	WW 250Ω 10% 1W°	25815-102
A2/S - Oscillator Assembly		
C3	Cer 4700pF +100-0% 350V	26372-615
C4	Cer 4700pF +100-0% 350V	26372-615
C5	Plas 0.1μF 10% 250V	26512-228
C6	Plas 470pF 2% 125V	26516-406
C7	Plas 470pF 2% 125V	26516-406
PLB	BNC 50Ω	23443-305
delete socket, CRYSTAL (1 of 3)		28313-605
SKTB	BNC 50Ω	23443-443
SKTC	BNC 50Ω	23443-443
A2c/S - Frequency Changer, TM 9030		
C1	Plas 835pF 2% 125V	26516-468
C2	Plas 0.00161μF 2% 125V	26516-538
C3	Plas 0.00169μF 2% 125V	26516-541
C4	Plas 0.00169μF 2% 125V	26516-541
C5	Plas 0.00136μF 2% 125V	26516-516
C6	Plas 0.01μF 2% 125V	26383-055
C7	Plas 165pF 2% 125V	26516-297
C8	Cer 1.5pF ±0.25pF 750V	26324-008
C9	Cer 0.1μF +50-25% 30V	26383-031
C10	Plas 0.0016μF 2% 125V	26516-535
C11	Plas 190pF 2% 125V	26516-311
C12	Plas 200pF 2% 125V	26516-315
C13	Plas 60pF 2% 125V	26516-188
C14	Plas 180pF 2% 125V	26516-303
C15	Cer 0.1μF +50-25% 30V	26383-031
C16	Cer 0.1μF +50-25% 30V	26383-031
C17	Elec 2μF +100-20% 25V	26414-109
C26	Plas 100pF 2% 125V	26516-188
C27	Plas 0.001μF +40-20% 500V	26516-538
L1	2.95μH	44237-906
L2	3.4μH	44237-405
L3	3.46μH	44237-403
L4	3.36μH	44237-404
L5	0.72μH	44224-404
L6	0.72μH	44224-404
L7	0.85μH	44126-802
L8	Not allocated	-
L9	1.25μH	44231-122
L10	Not allocated	-
L11	0.55μH	44225-015
MR1	CG91H	28321-311
R2	Carb 27kΩ 10% 0.1W*	24341-320
R3	Carb 5.6kΩ 10% 0.1W*	24341-303
R4	Carb 470Ω 10% 0.1W*	24341-269
R5	Met ox 220Ω 7%TE 3/8W**	24552-058
R6	Carb 27kΩ 10% 0.1W*	24341-320

Circuit Ref.	Description	M.I. code
R7	Carb 15kΩ 10% 0.1W*	24341-314
R8	Carb 27Ω 10% 0.1W*	24341-231
R13	Carb 100Ω 10% 0.1W*	24341-250
R14	Carb 2.7kΩ 10% 0.1W*	24341-292
R15	Carb 270Ω 10% 0.1W*	24341-261
VT1	A1827	28451-577
VT2	A1505	28455-306
VT3	Not allocated	-
VT4	A1827	28451-577

A2d/S - 12.5 Mc/s Oscillator, TM 9029

C20	0.1μF +50-25% 25V	26383-674
C21	82pF ±2pF 125V	26516-222
C22	30pF ±2pF 125V	26516-117
C23	100pF ±2pF 125V	26516-241
C24	470pF ±2pF 125V	26516-406
C25	0.1μF +50-25% 25V	26383-674
R9	27Ω 10% 0.1W*	24341-231
R10	220Ω 10% 0.5W*	24342-058
R11	27kΩ 10% 0.1W*	24341-320
R12	15kΩ 10% 1/10W*	24341-314
RV2	2.2kΩ 20% ¼W*	25611-018
VT3	A1827	28451-577

A9/S : the same as unit A9 in EB 2300

A10/S : the same as unit A10 in EB 2300

A14/S - Component Board, TM 8742

C1	Elec 100μF +100-20% 25V	26417-158
R1	Met ox 18kΩ 7%TE 3/8W**	24552-116
RV1	WW 5kΩ 10% 1W°	25811-547

Section 6

Circuit diagrams

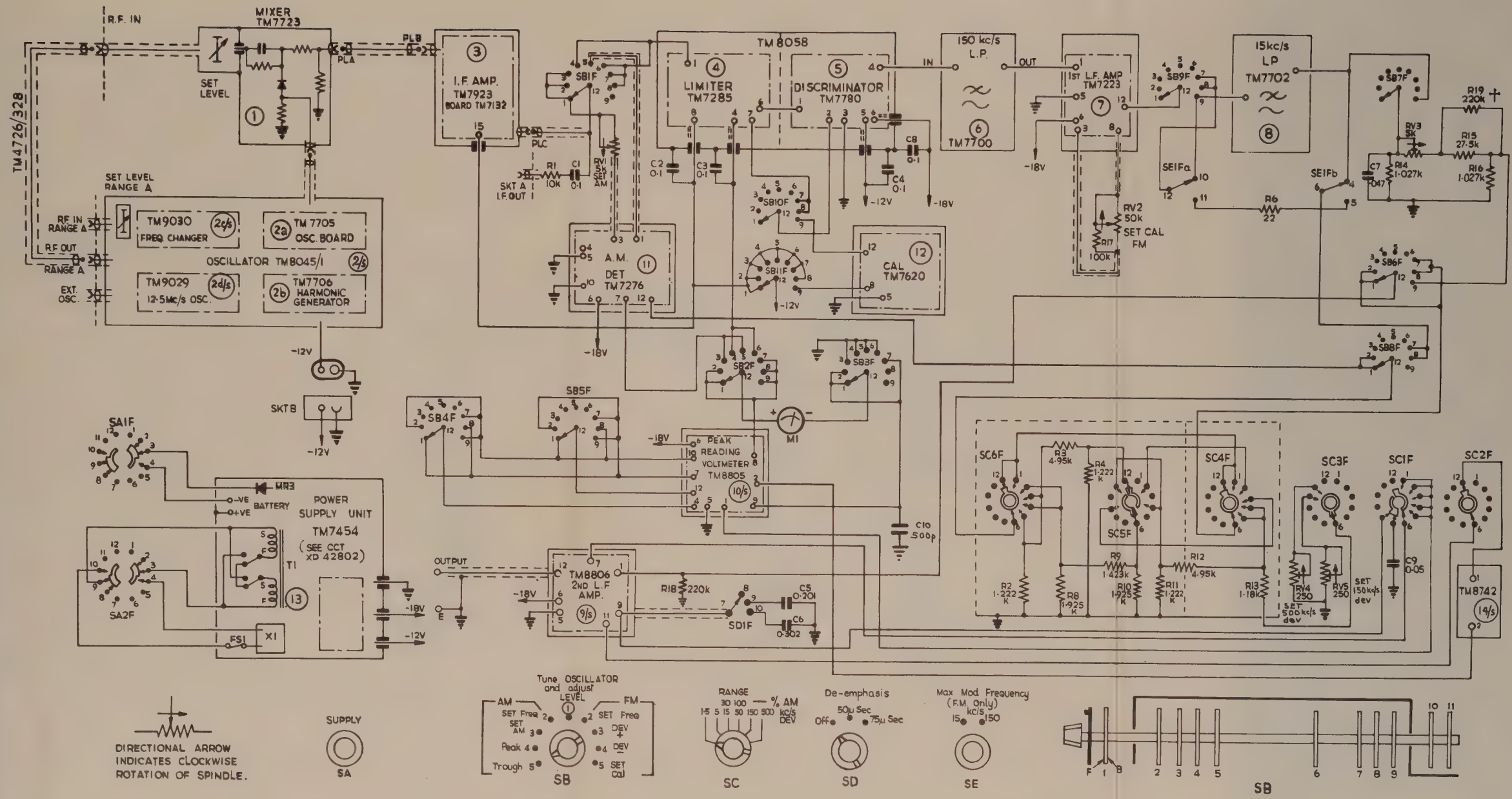
1. Arrangement

The inter-unit wiring diagram, Fig. 6.1, shows all sub-assembly units in the equipment together with their reference designators (A1, A2, etc.) and type numbers (prefixed TM). Components that are not on a sub-assembly are part of the main chassis assembly (designated A0). The units in the TF 2300S which are different from those in the TF 2300 have /S added after the reference designator (2/S, 10/S) on the inter unit wiring diagram, and are in this supplement: all the other circuits are identical with those in the EB 2300 Section 7.

Circuit diagrams are arranged in order of the sub-assembly designations.

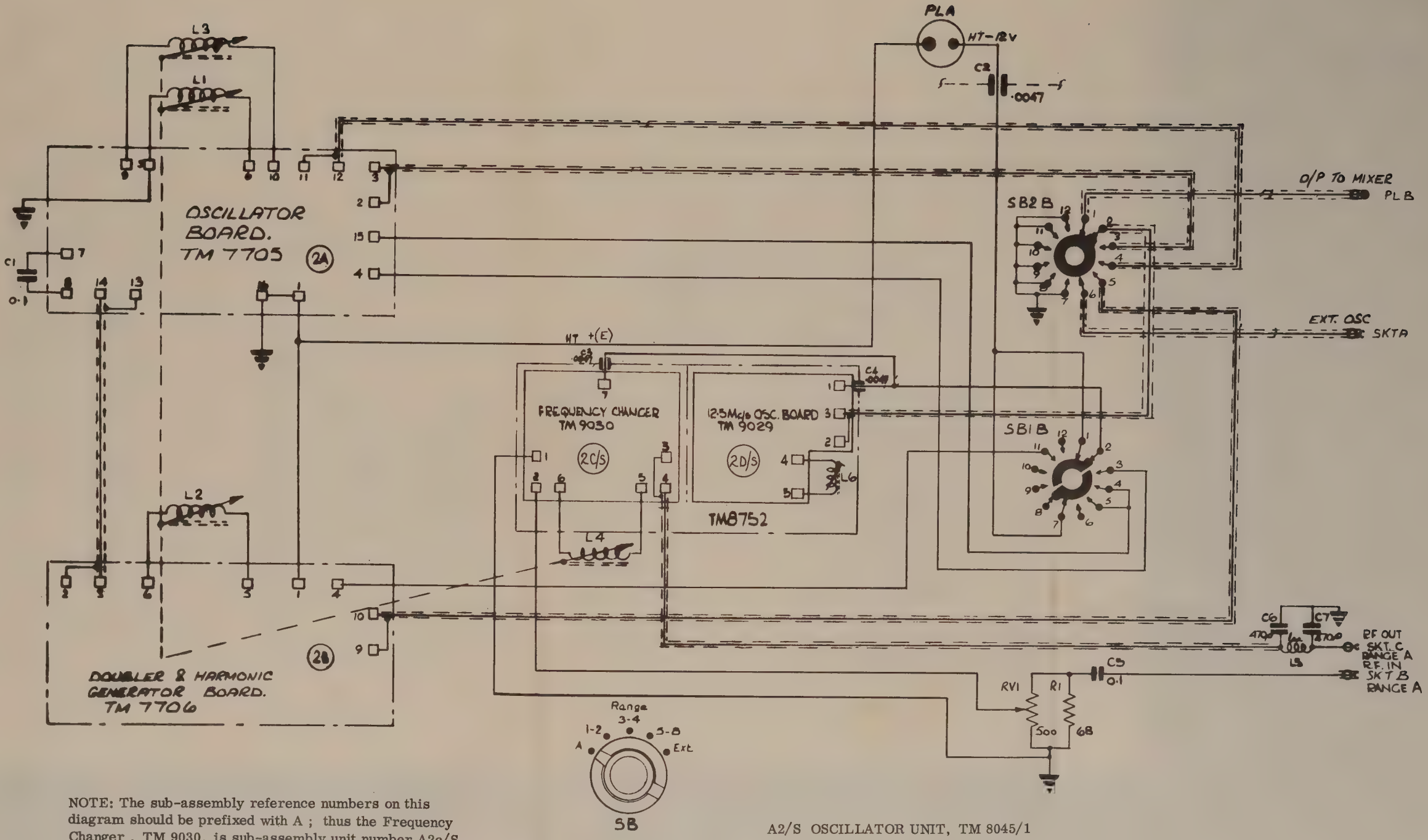
2. Component values

Resistor: No suffix = ohms, k = kilohms, M = megohms.
Capacitors: No suffix = microfarads, p = picofarads.
Inductors: No suffix = henries, m = millhenries, μ = microhenries.
† : value selected during test, nominal value shown.



NOTE: The sub-assembly reference numbers on this diagram should be prefixed with A; thus the Frequency Changer , TM 9030, is sub-assembly unit number A2c/S.

Fig. 6.1 Chassis inter-unit wiring



NOTE: The sub-assembly reference numbers on this diagram should be prefixed with A ; thus the Frequency Changer , TM 9030, is sub-assembly unit number A2c/S.

A2/S OSCILLATOR UNIT, TM 8045/1

Fig. 6.2 Oscillator unit

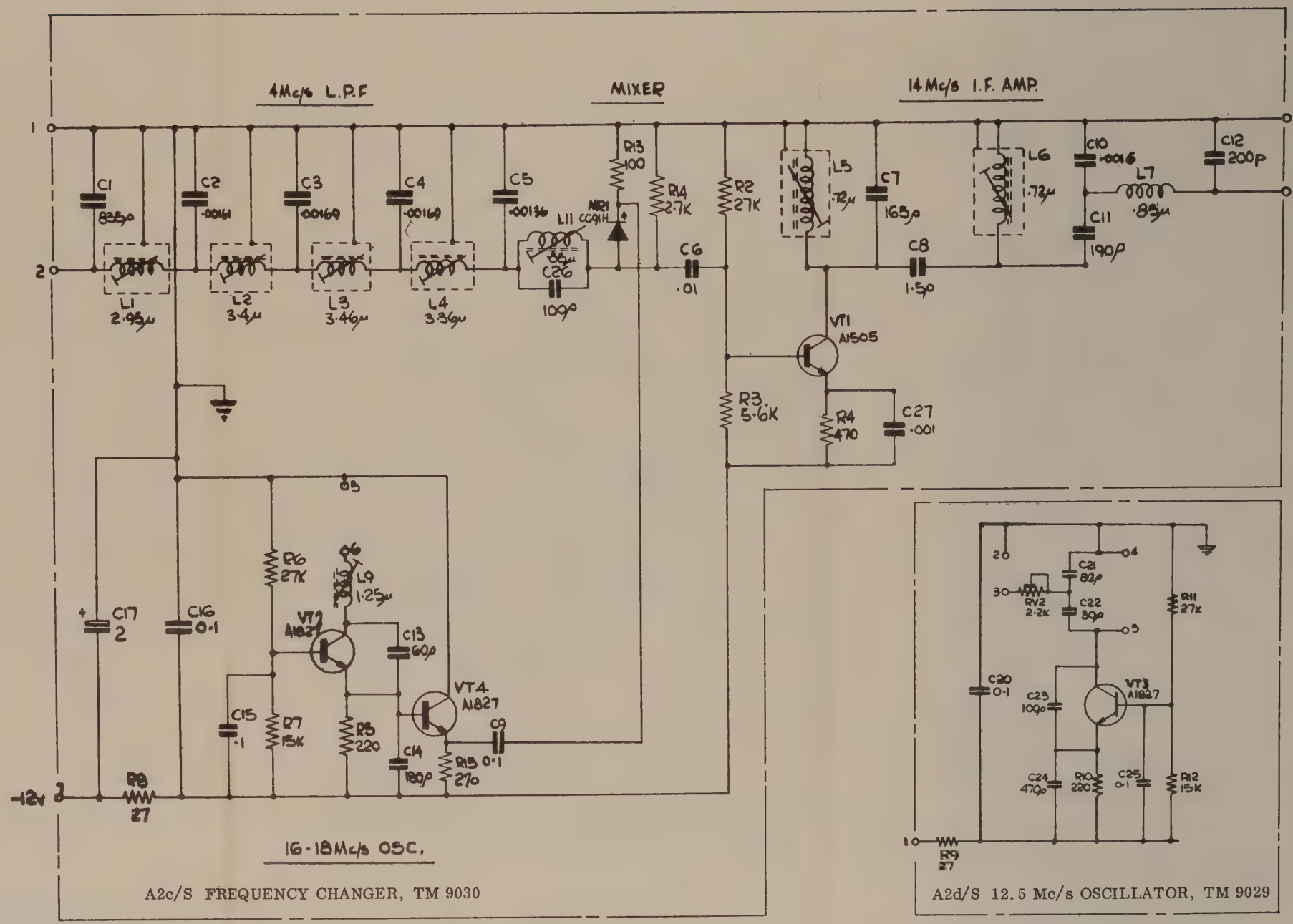


Fig. 6.3 Frequency changer, 12.5 Mc/s Oscillator

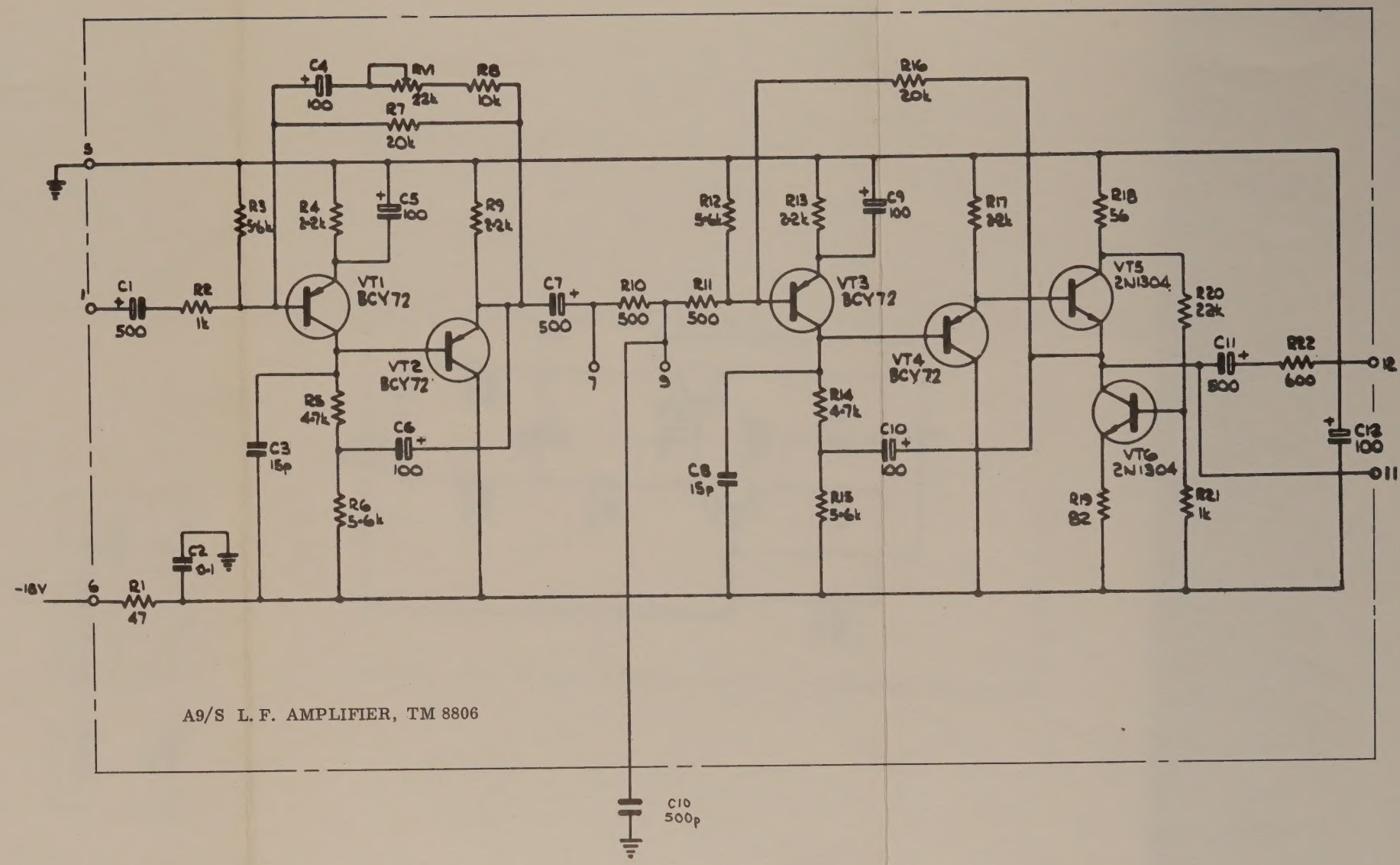
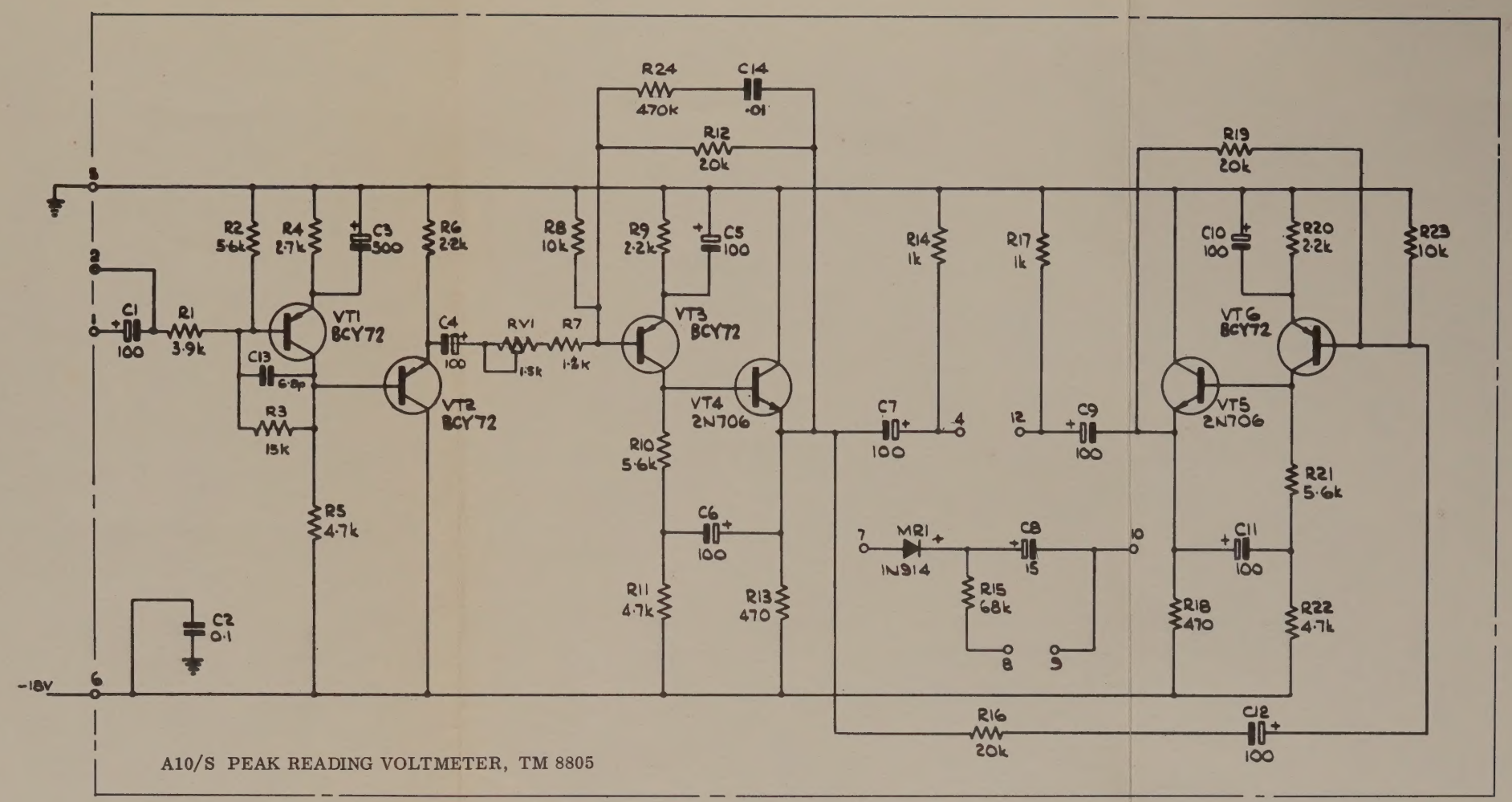


Fig. 6.4 2nd l.f. amplifier



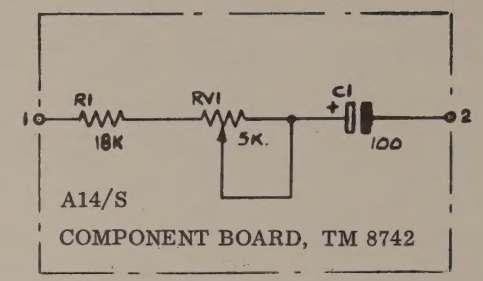


Fig. 6.5 Peak reading voltmeter